Notes on Philotria Raf.

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When trying to determine the Rocky Mountain specimens of *Philotria*, I happened to run across Caspary's very interesting paper on "Die Hydrilleen" in the Jahrbücher für wissenschaftliche Botanik.* It is rather surprising that very little has been written in this country on this American genus, when Caspary devotes over 50 pages to this genus and 137 pages to the tribe *Hydrilleae*. The genus needs, however, a good deal of more critical study in the field and these notes are written to call attention to this very interesting genus of water plants. I shall here give a short recapitulation of its history.

The genus was first described in Michaux's Flora Boreali-Americana † under the name *Elodea*, which, however, is antedated by *Elodes* Adans. Here the genus is characterized as having hermaphrodite flowers with three stamens, thick filaments, cordate anthers, and three bifid styles. The leaves in *E. canadensis* Michx. are described as being oblong and obtuse.

Muhlenberg ‡ referred the plant to the Old World *Serpicula verticillata*, described the staminate flowers as 4-merous, and added a variety *angustifolia* with narrow leaves.

The next description we find in Pursh's Flora Americae Septentrionalis § as *Serpicula occidentalis*. The description here agrees with that in Michaux's Flora, except that the leaves are described as linear, acute, and finely serrulate.

Rafinesque || gave no description, but merely changed Michaux's *Elodea* to *Philotria* on account of the earlier *Elodes* of Adanson.

Nuttall ¶ proposed a new genus *Udora* and cited *Elodea*

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* 1 : 377–513. 1858.
† 1 : 20. 1803.
‡ Cat. Pl. Am. Sept. 84. 1813.
§ 1 : 23 and 33. 1814.
|| Am. Monthly Mag. 2 : 175. 1818.
¶ Gen. N. Am. Pl. 2 : 242. 1818.

Michx. as a synonym but described the plant as dioecious, the staminate flowers with nine stamens in two series, the inner of which has three stamens, and the pistillate flowers with three sterile filaments and three ligulate bifid stigmas. He added further: "flowers very small and evanescent, the female emerging; the male migratory, breaking off connection usually with the parent plant, it instantly expands to the light, the anthers also burst with elasticity and the granular pollen vaguely floats upon the surface of the water." He described the leaves as oblong-linear, minutely serrulate, and partly obtuse.

Torrey* described *Udora* as being polygamous. "STERILE FL[OWERS]. Stamens 9: anthers oval, nearly sessile. PERFECT FL[OWERS]. Tube of the perianth produced above the ovary into a very long slender tube. Stamens 3–6: filaments short, subulate: anthers oblong, innate; the cells parallel, distinct . . . stigmas 3, large, spreading, oblong-cuneiform, 2-lobed." He described the leaves as varying from oblong-ovate to lanceolate-linear.

How are these conflicting descriptions to be reconciled? Have some of the authors mentioned been mistaken? Are there more than one species confused or is *Philotria canadensis* (Michx.) Britton such a variable plant both as to flowers and leaves? If more than one species, are they all polygamo-dioecious with three kinds of flowers: staminate with very short calyx-tube and 9 stamens; pistillate with long tube and no stamens or merely rudimentary filaments; and hermaphrodite flowers with long tube and 3–6 stamens? These are questions to be answered and botanists who have a chance to study the plants in the field will be well paid in investigating these interesting water-weeds. The writer would also be very thankful for material.

Let us see what is the present knowledge of the genus. Let us take up the different species proposed and the different descriptions, in the order they appear.

ELODEA CANADENSIS Michx. Fl. Bor.-Am. **1**: 20. 1803.

This was described as having hermaphrodite flowers with 3 stamens and bifid stigmas, and oblong, obtuse leaves. Is there such a plant? Caspary, who saw the original Michauxian material at Paris, stated that the two flowers found there were hermaphrodite

* Fl. N. Y. **2**: 264. 1843.

as described. He stated also that he had examined eight specimens collected by Moser in Pennsylvania, in 1832, and one by Schweinitz. These were all hermaphrodite, with from 2 to 7 stamens. In the Torrey herbarium there is a specimen of Moser's collection, but the tops of the flowers are broken off. In this specimen, however, the leaves are not oblong and obtuse, as described by Michaux, but linear and acute. There are other specimens in our herbaria with oblong or oblong-ovate leaves. One of these represents *Udora canadensis* of Torrey's Flora of New York from Torrey's sets distributed in connection with that publication. The flowers are hermaphrodite, as Torrey described his fertile flowers. Torrey stated that he had not seen any living sterile flowers but drew his description of them from material collected by Engelmann. This material I shall discuss later. There are other broad-leaved specimens, viz.: from Watertown, N. Y., 1834, *Dr. Gray;* East Haven Pond, Conn. (collector not given); Thousand Islands, N. Y., July 16, 1889, *John Northrop;* Prior's Lake, Minn., 1891, *C. A. Ballard;* Fish Creek, Sylvan Beach, N. Y., *L. M. Underwood 3211;* Waynesborough, Va., 1897, *W. A. Murrill;* Chilson Lake, N. Y., 1900, *Dr. & Mrs. N. L. Britton;* but all these have no flowers or the flowers are in such condition that it is impossible to say whether they are pistillate or hermaphrodite. None of these specimens has any sessile staminate flowers. Then the question arises: is the broad-leaved, *i. e.*, the typical *Philotria canadensis* (Michx.) Britton always hermaphrodite? Nobody, so far as I can find, has described any staminate flowers in connection with broad, oblong leaves.

SERPICULA VERTICILLATA Muhl. Cat. Pl. Am. Sept. 84. 1813.

This is described as monoecious and 3-androus, but the statement that the sepals and petals of the staminate flowers are four must have been an error or else Muhlenberg's specimens were abnormal. What it really was is of little consequence, as it is not *Serpicula verticillata* L.

SERPICULA VERTICILLATA ANGUSTIFOLIA Muhl. Cat. Pl. Am. Sept. 84. 1813.

This is of interest as it is the first name as far as known applicable to a form evidently distinct from *Elodea canadensis* Michx.

As far as I know, it is dioecious. The leaves are narrowly linear, acute, usually over 1 cm. long and about 1 mm. wide. The spathe of the staminate plant is 2–3 mm. long, subsessile, ovoid; the sepals and petals are elliptic, 2 mm. long; stamens 9; anthers oblong, about 1 mm. long. Spathe of pistillate plant linear-tubular, about 1 cm. long; tube of the flower 3–8 cm. long; sepals oblong, fully 1.5 mm. long; stamens none (only rudimentary filaments); stigmas 3, linear (whether 2-cleft or not cannot be determined). The name *Philotria angustifolia* was given to it in the Torrey herbarium. This name was taken up by me in my Flora of Colorado, but there applied to another species. It is represented by the following specimens: west side of 3d Ave., New York City, 1851, *Dr. Torrey & Dr. Gilman* [later than the publication of Torrey's Flora of New York], staminate and pistillate flowers; pool along Hudson River, below Hastings, 1895, *E. P. Bicknell*, pistillate flowers; brook from Fairy Dell, near Quogue, Long Island, 1885, *E. G. Knight*, pistillate flowers; Harrisburg, Pa., 1895, *J. K. Small*, sterile; Baltimore Co., Md., 1890, *K. A. Taylor*, pistillate flower (?), but only tube left; McCall's Ferry, Pa., 1893, *J. K. Small*, sterile. To this may also be counted the specimen of Moser mentioned above in the Torrey herbarium, which has however somewhat broader leaves. If this had hermaphrodite flowers, like the specimens seen by Caspary, this species may have all three kinds of flowers.

SERPICULA OCCIDENTALIS Pursh, Fl. Am. Sept. **1**: 33. 1814.

This agrees with *Elodea canadensis* Michx. in description, except that the leaves are described as linear and acute. There is, however, no specimen with hermaphrodite flowers and linear leaves in our collections, unless that of Moser had such.

UDORA CANADENSIS Nutt. Gen. N. Am. Pl. **2**: 242. 1818.

This is described as being dioecious, having staminate flowers with 9 stamens, pistillate ones with 3 sterile filaments and 3 ligulate, bifid stigmas, and oblong-linear, partly obtuse leaves.

This description fits a form somewhat similiar to the plants referred to *Elodea canadensis* Michx., but with more narrowly oblong, often somewhat acutish leaves. It is represented by the following specimens: Clifton, Passaic Co., N. J. 1891, *Geo. V.*

Nash, staminate and pistillate flowers; Buffalo, N. Y., *G. W. Clinton*, pistillate; Kendall, Orleans Co., N. Y., 1878, *H. S. Burnett;* Lake View, Jefferson Co., 1891, *Underwood*, pistillate; Fish Creek, Oneida Lake, N. Y., 1890, *Underwood*, pistillate; Wallace Switch, Va., 1892, *J. K. Small*, sterile. Nash's specimens are the only ones that have staminate flowers. The spathe is like that of *P. angustifolia*, but larger, 5–6 mm. long, the anthers in the unopened flower 2–2.5 mm. long. The *Udora canadensis* Nutt. may represent the unisexal form of *Elodea canadensis* but all these unisexual plants have narrower leaves than the specimens referred to the latter. It may represent a distinct species; if so, its name would be **Philotria Nuttallii,** as *Anacharis Nuttallii* Planch. was mostly based on this form.

ANACHARIS ALSINASTRUM Babingt. Ann. & Mag. Nat. Hist. II. **1**: 85. 1848.

This was described from specimens collected at Foxton Locks, near Market-Harborough, Leicester, England. The plant was at first looked upon as indigenous, but is now generally regarded as introduced. Babington's specimens, like all those collected in Europe, have only pistillate flowers; staminate and hermaphrodite ones are wholly unknown. The flowers have three oblong sepals and petals, three sterile filaments and club-shaped entire or merely emarginate stigmas, and oblong, obtusish leaves, sometimes as broad as those of *Elodea canadensis* Michx., sometimes hardly broader than those of *Udora canadensis* Nutt. or *Anacharis Nuttallii* Planchon, but always obtuse. This may be the pistillate form of *Elodea canadensis*, if this is polygamo-dioecious. The specimens in our herbaria are all European: canal near Hasselt, Villefranche, Rhône, France, 1874, *A. Mêhu;* Lago di Manlova, Maggio, Italy, 1895, *De-Toni;* Göta Elf, Sweden, 1899, *C. G. H. Thedenius;* Ostende, Belgium, 1871, *E. Cosson;* Spree, Berlin, Germany, 1877, *Mueller & Retzdorff;* Leigh Park, Hampshire, England, 1850. I collected it myself in the 1870's at Skara, Sweden.

ANACHARIS NUTTALLII Planch. Ann. Sci. Nat. Bot. III. **11**: 74. 1849.

This is based on *Udora canadensis* Nutt. Planchon distinguished it from *A. Alsinastrum* by the oblong-linear, not oval-

oblong leaves, and the bifid, instead of emarginate, stigmas. Caspary includes herein also the specimens collected at St. Louis, Mo., and distributed as *Udora verticillata*? *minor* Engelm., but this I believe to be distinct. See below.

ANACHARIS CANADENSIS Planch. Ann. Sci. Nat. Bot. III. **11**: 75. 1849.

Planchon's description differs considerably from that of Michaux and he could not have had the same plant in mind. The plant is said to be dioecious, the spathe of the staminate flowers ventricose-obovate and short-peduncled, and the staminate flowers themselves apetalous. It was described from staminate specimens collected by Drummond in Saskatchewan and imperfect pistillate specimens from Canada collected by Cleghorn. There is no evidence that the two belonged to the same species, but the staminate plants of Drummond must be regarded as the type. On these was based

ELODEA PLANCHONII Casp., Jahrb. Wiss. Bot. **1**: 468. 1858.

This is evidently a very distinct species and unique in the two characters given. The staminate flowers are much larger than in the other North American species, but the pistillate ones are as small as those of *Philotria minor* Small (*Udora verticillata minor* Engelm.). The leaves are usually as narrow as in that species, and in *Philotria angustifolia* (Muhl.) Britton. In my Flora of Colorado I referred the specimens of that state to those species. Having discovered my mistake, I shall here give a fuller description of the plant:

Philotria Planchonii (Casp.) Rydb.

Dioecious water-plant; stem slender, 1–5 cm. long; leaves in 3's or the lower opposite, 7–15 mm. long, oblong to lance-linear, acutish; spathe of the staminate flowers obovoid-clavate, nearly 1 cm. long, on a peduncle 5–10 mm. long; flowers short-pediceled; sepals elliptic, 5 mm. long; petals lacking; stamens 9, anthers oblong, 3–4 mm. long, subsessile; spathe of the pistillate plant linear or lance-linear, sessile, 2-cleft at the apex; calyx-tube slender, 3–5 cm. long; sepals and petals linear, about 3 mm. long; styles 3, linear; stamens none.

The following specimens belong here: Seven Mile Lakes, Albany County, Wyo., 1901, *Leslie N. Gooding 597*, staminate; Fish

Hatchery, Wyo., 1898, *Aven Nelson 5374*, pistillate; Lee's Lake, Colo., 1897, *C. S. Crandall 2423*, staminate; 1896, *2421*, fruit; Rio Grande, Alamosa, Colo., 1896, *C. L. Shear 3746*, staminate and pistillate; Wadsworth, Nev., 1887, *Tracy & Evans 475*, pistillate.

APALANTHE SCHWEINITZII Planch. Ann. Sci. Nat. Bot. III. **11**: 76. 1849.

Planchon distinguishes the genus *Apalanthe* from *Anacharis* by the hermaphrodite instead of dioecious flowers. Of how little value these characters are as generic distinctions may easily be settled by field work. From the description, this must be identical with *Serpicula occidentalis* Pursh. Of course, it is also *Elodea Schweinitzii* Casp. Jahrb. Wiss. Bot. **1**: 468. 1858.

ELODEA LATIFOLIA Casp.; Jahrb. Wiss. Bot. **1**: 467. 1858.

This was described from sterile material collected by Schweinitz. It was characterized by broad ovate-oblong leaves and rounded toothed stipules. Why is this not the typical *Elodea canadensis* Michx.?

UDORA VERTICILLATA ? MINOR Engelm.; under *Anacharis Nuttallii* Casp. Jahrb. Wiss. Bot. **1**: 465. 1858.

As stated before, Caspary included in *Anacharis Nuttallii* the specimens collected by Engelmann near St. Louis, Mo., and he cited Engelmann for the main part of the description of the flowers. I think, however, that Engelmann's plant is distinct from both the plant described by Nuttall and the plant collected by Torrey in New Jersey, which is the only one cited by Planchon. It is closely related to *Philotria angustifolia* (Muhl.) Britton, differing mostly in the size of the plant and the flowers. The spathe of the staminate plant is subglobose, 2 mm. long; sepals ovate; petals narrowly ovate, 1.5 mm. long; stamens 9, anthers scarcely 1 mm. long; spathe of the pistillate plant linear-tubular, 1 cm. long, 0.5 mm. thick; tube of the flower very slender, 3–6 cm. long; sepals and petals ovate, 1–1.5 mm. long; stigmas 3, club-shaped, bifid; leaves linear, acute, 5–8 mm. long, 1 mm. wide. This species is represented by the following specimens: St. Louis, Mo., 1845, *Engelmann*, pistillate and staminate plants, 3 sheets; Banks of Mississippi, Oquawka, Ill., *H. N. Patterson*, pistillate; Lexing-

ton, Ky., *Robert Peters*, pistillate; Linn County, Kansas, 1897, *G. L. Clothier*, sterile; Fox Lake, Wayne Co., Ohio, 1899, *Selby & Duvel 1321*, sterile; Milwaukee, Wis., 1887, *H. E. Hasse*, pistillate, long-leaved. The form has been raised to specific rank under the name

PHILOTRIA MINOR (Engelm.) Small, Fl. SE. U. S. 47. 1903.

Besides these, there seems to be another undescribed species:

Philotria linearis sp. nov.

Apparently dioecious, stem slender, 3–5 dm. long; leaves linear, acute, about 1 cm. long, scarcely 1 mm. wide, entire; spathe of the staminate plant peduncled; peduncle 3–4 mm. long; body ovate, about 3 mm. long; sepals broadly oval, 2.5 mm. long; petals oblong; stamens 9, anthers oblong, 2 mm. long.

The type was collected in swamps bordering on Cumberland River, vicinity of Nashville, Tenn., by Dr. A. Gattinger. The pistillate plant is unknown unless a specimen collected at Center City, Minn., in 1892, by B. C. Taylor, belongs here. It resembles the pistillate plant of *P. minor*, but the leaves are longer and more flaccid; the tube of the flower is 4–6 cm. long; the sepals and petals more oblong.

P. linearis resembles *P. Planchonii* in having stalked staminate spathe, but differs in that the spathe itself is much smaller and abruptly contracted at the base, the sepals are of about half the size of those of that species, and petals are present.

With the material on hand it is almost impossible to determine how many species are found in this country and their limitation. From the present knowledge I would think the number to be at least six. Of these I append here a temporary key, wishing to call the attention of the botanists of this country to the confusion existing and to give a tentative basis on which to build further study.

Leaves oblong or ovate-oblong, mostly obtuse; staminate flowers unknown. *P. canadensis.*

Leaves linear or oblong, mostly acute; hermaphrodite flowers unknown.

Staminate spathe sessile.

Leaves oblong or lance-oblong, 2–3 mm. wide, spathe of staminate flowers 5–6 mm. long; anthers 2–2.5 mm. long. *P. Nuttallii.*

Leaves linear, 1 mm. wide or less; staminate spathe 2–3 mm. long; anthers about 1 mm. long.

Leaves 1 cm. long or more; sepals and petals 1.5–2 mm. long. *P. angustifolia.*

Leaves 5–8 mm. long; sepals and petals 1–1.5 mm. long. *P. minor.*

Staminate spathe peduncled.

Staminate spathe ovoid, abruptly contracted at the base; sepals 2.5 mm. long; petals present. *P. linearis.*

Staminate spathe obovoid, tapering at the base; sepals of the staminate flowers 5 mm. long; petals lacking. *P. Planchonii.*

The synonymy would be as follows:

PHILOTRIA CANADENSIS (Michx.) Britton, Science II. **2**: 5. 1895.

Elodea canadensis Michx. Fl. Bor.-Am. **1**: 20. 1803.

? Anacharis Alsinastrum Babingt. Ann. & Mag. Nat. Hist. II. **1**: 85. 1848.

Elodea latifolia Casp. Jahrb. Wiss. Bot. **1**: 467. 1858.

PHILOTRIA NUTTALLII (Planch.) Rydb. [See above.]

Serpicula verticillata Muhl. Cat. Pl. Am. Sept. 84. 1813. Not *S. verticillata* L. f. 1781.

Udora canadensis Nutt. Gen. N. Am. Pl. **2**: 242. 1818.

Anacharis Nuttallii Planch. Ann. Sci. Nat. Bot. III. **11**: 74. 1849.

PHILOTRIA ANGUSTIFOLIA (Muhl.) Britton; Rydb. Bull. Agr. Exp. Sta. Colo. **100**: 15. 1906.

Serpicula verticillata angustifolia Muhl. Cat. Pl. Am. Sept. 84. 1813.

? Serpicula occidentalis Pursh, Fl. Am. Sept. **1**: 33. 1814.

? Serpicula canadensis Eat. Man. 391. 1829. [Ed. 5.]

? Apalanthe Schweinitzii Planch. Ann. Sci. Nat. Bot. III. **11**: 76. 1849.

? *Elodea Schweinitzii* Casp. Jahrb. Wiss. Bot. **1**: 468. 1858.

PHILOTRIA MINOR (Engelm.) Small. Fl. SE. U. S. 47. 1903.

Udora verticillata ? *minor* Engelm.; Casp. (synonym under *Anacharis Nuttallii*) Jahrb. Wiss. Bot. **1**: 465. 1858.

PHILOTRIA LINEARIS Rydb. [See above.]

PHILOTRIA PLANCHONII (Casp.) Rydb. [See above.]

Anacharis canadensis Planch. Ann. Sci. Nat. Bot. III. **11**: 75. 1849.

Elodea Planchonii Casp. Jahrb. Wiss. Bot. **1**: 468. 1858.

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